

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
Before the Board of Patent Appeals and Interferences

# 21/3043

In re Patent Application of

**VUORINEN et al**

Atty. Ref.: **30-336**

Serial No. **08/925,321**

Group: **1731**

Filed: **September 8, 1997**

Examiner: **Alvo**

For: **METHOD OF TREATING CELLULOSIC  
PULP**

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May 20, 1999

Honorable Commissioner of Patents  
and Trademarks  
Washington, DC 20231

**APPEAL BRIEF**

Sir:

Applicant hereby appeals the Final Rejection of March 1, 1999, Paper No. 19.

**I. REAL PARTY IN INTEREST**

The real parties in interest are A. Ahlstrom Corporation and Ahlstrom Machinery Corporation, corporations of the country of Finland.

**II. RELATED APPEALS AND INTERFERENCES**

The appellant, the undersigned, and the assignee are not aware of any related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

### **III. STATUS OF CLAIMS**

Claims 1, 3 through 8 and 10 through 31 are pending and have been rejected.  
Claims 2 and 9 have been canceled. No claims have been substantively allowed.

### **IV. STATUS OF AMENDMENTS**

No amendments have been filed since the date of the Final Rejection.

### **V. SUMMARY OF INVENTION**

The invention seeks to eliminate or minimize the disadvantages of the prior art and to provide a totally new procedure for bleaching cellulose pulps, in particular cellulose pulps delignified under alkaline conditions, by means of either totally chlorine-free bleaching chemicals, or by using chlorine dioxide. The cellulose pulp produced according to the invention is easily bleached, e.g. by means of oxygen and/or peroxide.

The invention is based on the concept that by selectively removing hexenuronic acid from cellulose pulps in connection with bleaching it is possible to reduce the consumption of bleaching chemicals. Surprisingly, it has been discovered that at the same time, the brightness reversion tendency of pulp decreases. Also, bleaching becomes more selective, since the heavy metals can be removed more efficiently.

The claimed invention calls for a method of treating chemical cellulose pulp produced by alkaline delignification and having a kappa number of under 24, and having hexenuronic acid therein. The method comprises the following steps [page 16, line 8-page 17, line 11]: (a) Treating chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 and at a solids consistency of between

0.1-50% (e.g. 1-20%) by treating the pulp at a temperature over 85°C (e.g. 90-110°C) and at a pH between about 2-5 (e.g. 2.5-4) for sufficient time (e.g. 10-240 minutes) to remove at least 50% (e.g. at least about 80%) of the hexenuronic acid and to reduce the kappa number by at least 2 units (e.g. 3-6 units); and (b) bleaching (e.g. with peroxide) the chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 (e.g. 14 or less) in at least one bleaching stage. Typically step (a) is practiced for at least a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C. Also step (b) is practiced by bleaching the pulp with chemicals reacting electrophilically in at least one stage, and step (a) is practiced before step (b). Further, step (a) may be practiced by controlling the pH by the addition of an inorganic or organic acid, and at a temperature over 100°C.

The invention further relates to a method of producing chemical cellulose pulp, comprising the following steps (see page 17, line 12-page 18, line 2): (a) Effecting alkaline delignification of comminuted cellulosic fibrous material to produce chemical cellulose pulp having a kappa number of under 24, and having hexenuronic acid therein. (b) Treating the chemical cellulose pulp from step (a) at a temperature of between about 90-180°C and at a pH between about 2-5 for at least a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C, to remove at least 50% of the hexenuronic acid from the pulp. And (c) bleaching the chemical cellulose pulp from step (a) in at least one bleaching stage prior to, simultaneously with, or after step (b).

Further, the invention relates to a cellulose chemical pulp produced by the following steps (page 18, lines 7-16): (a) Effecting alkaline delignification of

comminuted cellulosic fibrous material to produce chemical cellulose pulp having a kappa number of under 24, and having hexenuronic acid therein. (b) Treating the chemical cellulose pulp from step (a) at a solids consistency between 0.1-50% (1-20%) at a temperature of between about 90-180°C and at a pH between 2.0-5.0 for at least a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C, to remove at least 50% (e.g. at least 80%) of the hexenuronic acid from the pulp. And (c) bleaching the chemical cellulose pulp from step (a) in at least one bleaching stage prior to, or after, step (b), so that the pulp has a brightness of at least about 80 ISO.

In addition, the invention relates to a method of treating chemical cellulose pulp produced by alkaline delignification and having a kappa number of 25.9 or less, having hexenuronic acid therein, comprising the following steps (see page 21, line 11-page 22, line 22, page 27, line 13-page 28, line 16, page 16, lines 8-21): (a) Treating chemical cellulose pulp produced by alkaline delignification having a kappa number 25.9 or less at a solids consistency of between 0.1-50% by treating the pulp at a temperature over 85°C and at a pH between about 3-4 for a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C. (b) Treating the pulp with a chelating agent (page 15, lines 22-27). And (c) bleaching the chemical cellulose pulp produced by alkaline delignification having a kappa number 25.9 or less in at least one bleaching stage (e.g. with peroxide,  $\text{ClO}_2$ , peracid, ozone, etc.).

## VI. ISSUES

Are claims 1, 3-8 and 10-31 properly rejected under 35 USC §103(a) as being unpatentable over EP 511 695 in view of "admitted prior art" (page 4, lines 13-22 of the instant specification) with or without Lachenal et al, and with or without Marechal?

## VII. GROUPING OF CLAIMS

All of the claims are independently patentably distinct from each other and from the prior art for the reasons set forth in detail in the Argument section below.

## VIII. ARGUMENT

**Claims 1, 3-8 and 10-31 are not properly rejected under 35 USC §103(a) as being unpatentable over EP 511 695 in view of "admitted prior art" (page 4, lines 13-22 of the instant specification) with or without Lachenal et al, and with or without Marechal**

Reconsideration is respectfully requested of the rejection of claims 1, 3 through 8, and 10 through 31 on page 2 of the Final Rejection as obvious over EP 511695 in view of allegedly admitted prior art with or without Lachenal et al, and with or without Marechal. It is respectfully submitted that there is no *prima facie* case of obviousness, the references do not teach the invention even if combined, and that the basic factual assumptions made in the Final Rejection that are the basis for the rejections are erroneous.

The invention is a remarkable advance in the art, and recognized as such by those in the art. An illustration of this is provided by the fact that inventor Vuorinen and others have published an article in the TAPPI 1996 International Pulp Bleaching

Conference entitled "Subjective Hydrolysis of Hexenuronic Acid Groups and Its Application in EFC and TCF Bleaching of Kraft Pulps" (a copy of this TAPPI Proceedings article was earlier provided). This illustrates the significance of the invention and the interest therein by those in the art. Also significant is the additional information submitted November 5, 1997, which has not been acknowledged or commented on in the Final Rejection.

In assessing the rejection, the Vuorinen declarations (incorporated by reference herein) and other information needs to be taken into account -- which was not done in the Final Rejection. Earlier Actions in this case did not evidence understanding of all claim limitations or the Vuorinen declarations, and even after these have been explained the rejections have been continued.

Responding first to the inquiry at the top of page 4 of the September 18, 1998 Action, it is respectfully submitted that the equation written there is not the real equation that is set forth in the claims; 10517 is not divided by [(T+273)-24], but by (T+273) and 24 is subtracted from the quotient (10517/(T+273)).

In response to the request for sample calculations for 85°C and 180°C, appellants provided the following calculations:

85°C

$$\begin{aligned} t &= 0.5 \exp\left(\frac{10517}{T+273} - 24\right) = 0.5 \exp\left(\frac{10517}{85+273} - 24\right) = 0.5 \exp\left(\frac{10517}{358} - 24\right) = 0.5 \exp(29.38 - 24) \\ &= 0.5 \exp(5.38) = 108 \text{ min} \end{aligned}$$

180°C

$$t = 0.5 \exp\left(\frac{10517}{180 + 273} - 24\right) = 0.5 \exp\left(\frac{10517}{453} - 24\right) = 0.5 \exp(23.22 - 24) = 0.5 \exp(-0.78) = 0.23 \text{ min}$$

It is also possible to determine the amount of hexenuronic acid that would be removed for various treatments by calculation from test results. For example for Table III (Exhibit D) of the first Vuorinen declaration only for a temperature of 80°C a pH of 2 for 40 minutes only 11.5% of the hexenuronic acid is removed, whereas if treatment is continued for two hours then still less than 50% (i.e. 30.6%) of the hexenuronic is removed.

Further the criticisms of the declarations of Vuorinen on pages 4 and 5 of the September 18, 1998 Action, and continued in the Final Rejection, are not appropriate. The key is not what references are specifically discussed in the Vuorinen declarations, but rather what conditions are involved and what conclusions can be drawn from those conditions. The conditions set forth in the Vuorinen first declaration are completely applicable to the preferred embodiments of the references. Also paragraph 8 of the Vuorinen first declaration makes it clear that a temperature of 90°C as suggested tangentially as a possibility (although outside the preferred range) of Lachenal et al is impractical because of the decrease in viscosity, and the same would be true of the 95° tangential reference (again completely outside the preferred range) of the EP 511695 reference.

Further, the suggestion that the first Vuorinen declaration does not compare the most relevant prior art to the claimed invention because it does not include the temperatures provided according to the present invention is in reality asking that the invention be compared to itself. This approach by the PTO is impermissible. In this

regard see *In re Tiffin*, 170 USPQ 88, 93, 443 F.2d 394 (CCPA 1971) wherein the court held:

"In the first place, we cannot agree that appellants' affidavits are irrelevant because they compare products of the claimed process to products of prior-art processes seriatim, rather than to products of the composite process fashioned by the examiner. The examiner's composite process is appellants' process, and thus cannot be compared with it. However, the question is whether, at the time appellants made their invention, it would have been obvious for those skilled in the art to have combined the prior-art processes in the manner set forth by the examiner and quoted *supra*, and on that question the superiority of the products of appellants' process to the products of each of the prior-art processes is highly relevant. *In re Schickh*, 53 CCPA 1352, 362 F.2d 821, 150 USPQ 300 (1966). We find nothing in *Heinrich*<sup>\*\*\*</sup>, *supra*, to the contrary. (emphasis added)

With respect to the second Vuorinen declaration, there is absolutely nothing about page 262, second paragraph, or the last paragraph of page 279 of Marechal, that provides any indication whatsoever that even Marechal thinks the severe viscosity loss set forth therein is "acceptable". There is absolutely nothing in Marechal itself to dispute anything in the second Vuorinen declaration, and there is nothing in Marechal that in any way minimizes or justifies the entirely unacceptable yield results set forth in paragraph 4 of the second Vuorinen declaration, therefore even if (which is not so) there was some portion of Marechal that taught that the enormous viscosity losses set forth therein were somehow "acceptable", that still would not make the Marechal reference anything more than something of academic interest, for the reasons set forth in the second Vuorinen declaration.

Reconsideration is respectfully requested of the rejection of claims 1, 3-8 and 10 through 31 as obvious over the EP 511695 and Lachenal et al references, both of

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<sup>\*\*\*</sup>*In re Heinrich*, 122 USPQ 388 (1959).

which are fully discussed in the instant application specification, in view of "admitted prior art" with or without Marechal. The rejection is based upon a number of erroneous factual premises. These include: (1) that there is any "admitted prior art" having any relevance whatsoever to the rejection; (2) that the EP 511695 reference would remove at least 50% of the hexenuronic acid at the pH, time, and temperature conditions set forth in the first example therein; (3) that the use of the temperature range according to the invention would be obvious to speed up "metal ion removal", or "to further reduce the Kappa No.".

With respect to (1), the specification does not in any way, shape or form admit that the recognition that hexenuronic acids are present in pulp is in the prior art. What page 4, lines 13 through 22, of the specification specifically provides is:

"It is known that cellulose pulps contain 4-O-methyl- $\alpha$ -D- glucuronic acid groups (glucuronic acid groups). According to the invention it has been discovered that sulphate pulps also contain, in addition to glucuronic acid groups, a significant amount of 4-deoxy- $\beta$ -L-threo-hex-4-enopyranosyl uronic acid groups (i.e. hexenuronic acid groups) bound to xylan. The amount of hexenuronic acid in some pulps is even substantially greater than the amount of known glucuronic acid groups. The term "hexenuronic acid" as used in the present specification and claims encompasses all 4-deoxy- $\beta$ -L-threo-hex-4-enopyranosyl uronic acid groups." (Emphasis added.)

Thus the "admitted prior art" is not "admitted". See also paragraph 5 of the first Vuorinen evidentiary declaration, which specifically disputes the allegation of "admitted prior art". Since the "admitted prior art" on which the rejection is based clearly is not admitted, the entire factual basis for the rejection fails!

(2) There is absolutely no basis for assuming that the treatment in Example 1 of EP 511695 ("the '695 reference") -- namely a pH of 2.3, temperature of 60°C, and a time of 30 minutes -- would remove at least 50% of the hexenuronic acid, as specifically

called for by independent claims 1, 18, 20 and 29-31. In fact applicants' evidence indicates it would not. In this regard attention is directed to the first evidentiary declaration of Tapani Vuorinen, Table 3 in Exhibit D (while the entire first Vuorinen declaration should be reviewed and is consistent with this, Table 3 is specifically referred to because it is believed it clearly shows the assumption in the Final Rejection is erroneous). Table 3 illustrates that with a pH of 2 at a temperature of 70°C and a duration of two hours (both the time and the temperature being significantly greater than in the '695 patent example, and the pH being slightly lower, all of which are likely to result in the removal of more hexenuronic acid) the amount of hexenuronic acid removed was about 6.5 meq/kg. From the last line in Table 3 it will be seen that the pulp had at least 40.0 meq/kg of hexenuronic acid, therefore it is clear that treatment pursuant to Example 1 of the '695 reference would result in removal -- at most -- of about 16% of the hexenuronic acid, not at least about 50%. Also, as discussed above, in a treatment at 80°C for two hours at pH 2, only 30.6% of the hexenuronic acid is expected to be removed (by calculation).

The object of the acid treatment according to the EP 511695 reference is to remove metals from the pulp in order to replace them with more suitable metals. In order to achieve this object, fairly low temperatures and reaction times are sufficient as demonstrated by the examples of EP 511695 where the highest temperature employed is 60°C which is clearly below the range given in claim 1. Further, it is to be taken into account that according to the teaching of EP 511695 higher temperatures are always combined with lower reaction times. In example 1 the acid treatment is performed at a temperature of 60°C for 30 minutes, and in example 2 the temperature is 50°C and the

time 60 minutes. If these values are arranged in a table, it becomes clear that a skilled man who intends to perform the process of the EP document at temperatures of at least 85°C would choose reaction times below 30 minutes. This period of time (i.e. below 30 minutes) is not sufficient to remove at least 50% of the hexenuronic acid as recited in claim 1. It is disclosed, for example, at page 10 of the specification that the typical treatment time at 90°C is about 1.5 to 6 hours.

	T	t
EP 511695 Example 2	50°C	60 min
Example 1	60°C	30 min
	85°C	<30 min

(3) There is nothing in the art that would suggest increasing the temperature in EP '695 or Lachenal et al so that it is over 85°C (as recited in claims 1-27 and 29-31) or between about 90-180°C (as recited in claims 18 and 20). Neither of the references teaches that one would get a significant beneficial effect on metal removal or Kappa No. reduction as a result of increasing the temperature past the maximum or preferred range thereof, and one of ordinary skill in the art would not increase the temperature to 85°C or above, or to about 90-180°C, because of a dramatic decrease in viscosity that would result, and is known in the art. In this regard attention is particularly directed to paragraph 4 of the first Vuorinen declaration, as well as the test data in Tables 1 and 2 (Exhibits B and C thereof) relating to viscosity. Note the unacceptable decrease in viscosity for treatment at pH 2 in Table 1, and 1.5 in Table 2, which clearly support the analysis provided in paragraphs 8 and 9 of the first Vuorinen declaration that the treatment described by Lachenal et al at 90°C is impractical. Nor do either of the

references teach the kappa number reduction as recited in claim 1. Lachenal et al disclose that raising the temperature in the acid treatment results in a further decrease of kappa no. after a peroxide stage, but do not teach or suggest that the kappa would decrease in the acid treatment prior to the bleaching stage.

The suggestion in the Final Rejection that it would have been obvious to use the higher temperatures disclosed by EP 511695, to speed up the metal ion removal step as chemical reactions are known to be temperature rate effective, actually provides a teaching contrary to the invention. The words "speed up" mean use less time. According to the present invention, higher temperatures and longer times are used. In the EP 511695 reference, the acid treatment is preferably effected at a temperature of 40-80°C for a time of 20-40 minutes while according to the present invention a preferred treatment is 90°C for 1.5 to 6 hours. Thus appellants' claimed invention does not "speed up" the treatment of the EP 511695 reference, but rather seeks to enhance the removal of hexenuronic acid. The EP 511695 reference, where metal removal is the goal, provides a short time at high temperature, not a longer time as according to the present invention. There simply and unequivocally is no reason why either Lachenal et al or EP 511695 would use both a higher temperature and as long or longer treatment time than in the preferred embodiment therein.

(4) The Marechal reference optionally applied in the Final Rejection is totally irrelevant to the invention, as made clear by the second Vuorinen declaration (incorporated by reference herein). Marechal has not carried out his tests under correct conditions whereby pulp of good quality would be obtained. This is indicated, for example, by a high yield loss of about 4-6% (Table 4) (-100% pulp yield), also at a pH

of 4.13. An acid treatment properly carried out according to the invention results in a yield loss of about 1%, at the most 2%. The yield loss after having reached final brightness in bleaching should be about 4%. Marechal has obtained the same yield loss or even higher already before bleaching. In addition pulp strength and pulp quality in the test of Marechal are poor.

The Final Rejection alleges that there is no evidence that the instant process obtains a better yield than the process of Marechal. However, a better yield, i.e. 98%, is disclosed in Example 8 of the instant application, therefore this factual basis for the rejection is also wrong!

The Marechal reference is completely ineffective prior art, and would not be consulted by one of ordinary skill in the art as made clear by the second declaration of Vuorinen. Therefore it cannot provide the proper basis for a rejection.

For these reasons alone, all the claims clearly patentably distinguish from Marechal.

In addition to the rejection in the Final Rejection being based upon the erroneous factual assumptions (1)-(4) set forth above, there clearly and unequivocally is no *prima facie* case of obviousness, and even if the references are combined the claimed invention does not ensue.

In chemical pulping, the chemical components of wood can be classified into two groups: those which form part of the cell wall and intercellular structure; and extraneous components which are not an essential structural feature of the wood. The cell wall and intercellular components of wood are of primary interest in pulp manufacture, and are in two main classes, polysaccharides (primarily cellulose and

hemicelluloses) and lignin. Hexenuronic acids are associated with hemicellulose xylans, that is a non-lignin component of the wood.

The basic concept of the invention is that by selectively removing hexenuronic acid groups from cellulose pulps in connection with bleaching it is possible to reduce the consumption of bleaching chemicals. The optimized conditions that are provided according to the present invention are solely to achieve this function -- namely hexenuronic acid group removal so as to reduce bleaching chemical consumption. Since the prior art does not even recognize that hexenuronic acids are present in significant quantity in chemical pulp and should be removed there is no suggestion whatsoever to one of ordinary skill in the art to perform the optimization that has been provided according to the present invention. In this regard see *In re Antonie*, 195 USPQ 6, 8 (CCPA 1977) wherein the Court held:

"In *In re Aller*, 42 CCPA 824, 220 F.2d 454, 105 USPQ 233 (1975), the court set out the rule that the discovery of an optimum value of a variable in a known process is normally obvious. We have found exceptions to this rule in cases where the results of optimizing a variable, which was known to be result effective, were unexpectedly good. *In re Waymouth*, 499 F.2d 1273, 182 USPQ 290 (CCPA 1974); *In re Saether*, supra. This case, in which the parameter optimized was not recognized to be a result-effective variable, is another exception. The decision of the board is reversed."

According to the invention it has also been surprisingly discovered that while the consumption of bleaching chemicals can be significantly reduced by the removal of hexenuronic acids the brightness reversion tendency of pulp decreases (typically the pulp has a pc number of less than 2) and bleaching becomes more selective since heavy metals can be removed more efficiently. These surprising aspects of the invention are also not disclosed in the art and provide no reason why one of ordinary

skill in the art would provide the optimized conditions which achieve that result according to the invention. Where the prior art does not recognize the advantages achievable according to the invention there can be no suggestion for a modification or combination of the references to provide the invention. See *In re Gordon*, 221 USPQ 1125, 1127 (Fed. Cir. 1984):

"We are persuaded that the board erred in its conclusion of prima facie obviousness. ... The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification."

The '695 reference suggests that after acid treatment metal ions advantageous for peroxide bleaching, such as magnesium ions, should be added since some of these metals are removed during acid treatment. In the '695 reference the acid treatment is effected at a temperature of 10-95°C, most preferably at 40-80°C, and in Example 1 (referenced in a previous Action) at 60°C; and at a pH of 1-6, most preferably 2-4 (2.3 in Example 1), for a time of 20-40 minutes (30 minutes in Example 1). Since the '695 patent relates significantly to metal ion removal there would be no reason to increase the time to more than 40 minutes. While extra time is not usually very harmful for removal of metals, it naturally causes extra costs to the mill, since long treatment times require use of larger tanks. Large tanks have also been avoided because it has been feared that the acid stage would harm the strength qualities of the pulp. (The decrease in strength qualities where the pH is low is confirmed by the first Vuorinen declaration.)

The '695 reference also takes an approach that is contrary to the invention. According to that reference mere acid treatment per se (see page 2, lines 25 through 33 and page 5, lines 22 through 24) is not provided, but rather the addition of

magnesium after acid treatment is necessary otherwise the desired viscosity and brightnesses are not obtained (see Table I, page 5). The '695 patent thus neither discloses or suggests a selective removal of hexenuronic acid from cellulose pulp, nor is there any hint as to what combination of pH, time, and temperature is needed to effect such removal.

Further, it would not be obvious "to increase the bleaching of the '695 reference by increasing the temperature of the acid treatment as taught by Lachenal" as alleged in the Final Rejection because the '695 reference teaches that pulp in the acid treatment is subjected to bleaching and/or delignifying treatment by adding suitable chemical during acid treatment (see page 3, lines 43 to 47 of the '695 reference). Thus the supposed bleaching/delignification problem has already been solved in the '695 reference, and there is no reason for one of ordinary skill in the art to combine it with Lachenal et al.

Lachenal et al disclose a process where the transition metals are removed from pulp with an acid treatment and the pulp is bleached with peroxide. Some experiments (Table 4) have been carried out at a temperature of 20-90°C. The acid concentration has been H<sub>2</sub>SO<sub>4</sub> % by weight of the dry pulp, which means that the pH is about 1.5, which is lower than the pH recited in the claims here (see paragraph 2 of the first Vuorinen declaration). It has been recommended that the temperature is preferably between 60-80°C, which is, again, lower than that in the claims here. As indicated above, Lachenal et al disclose that raising the temperature in the acid treatment results in a further decrease of kappa no. after a peroxide stage, but does not teach or suggest that the kappa would decrease in the acid treatment prior to the bleaching stage.

Corresponding experiments to those in Table 4 of Lachenal et al have been disclosed in Lachenal et al's Canadian patent 1,206,704<sup>1</sup> (an English language translation of Table 1 was previously submitted), which shows that the kappa number goes from 31 to 30.5. Had Lachenal et al known that the kappa could be reduced at least two units, they would have used the "correct" conditions of the invention.

Further, Lachenal et al have a teaching specifically contrary to the invention. Lachenal et al treat high kappa number pulp (kappa number 30 -- see page 146, left column, first paragraph, line 3), and their object is to remove lignin (not a non-lignin component which is removed according to the invention). They teach that the removal of lignin can be improved by pretreatment which activates the lignin for peroxide treatment. The invention of claims 1, 18, 20 and 27, on the other hand, has removed the majority of the lignin prior to the acid treatment (a kappa number of under 24)<sup>2</sup>. The invention relates to the removal of a component from the remaining substance, which component is attached to the non-lignin part of the pulp, that is to the hemicellulose xylan. Thus the teachings of Lachenal et al are specifically contrary to the invention, providing treatment of high lignin pulp in order to facilitate removal of the lignin therein.

There is no basis whatsoever on which one of ordinary skill in the art would select the non-preferred temperature range of Lachenal et al for acid treatment, yet ignore the teachings of Lachenal et al that require high lignin pulp in order to achieve

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<sup>1</sup> Submitted with the IDS filed January 25, 1996.

<sup>2</sup> Claim 27 calls for a kappa number of 25.9 (see page 21, line 12, of the instant application disclosure) or less.

Lachenal et al's desired results. Lachenal et al would consider the practice of the invention contrary to their purposes, and it can never be considered obvious to modify a reference in that regard. See *Hughes Aircraft Co. v United States*, 215 USPQ 787, 804 (Ct. Cl. 1982), relevant portions affirmed 219 USPQ 473 (Fed. Cir. 1983), wherein the Court held:

"Furthermore, it is generally settled that a change in a prior art device which makes the device inoperable for its intended purpose cannot be considered to be an obvious change.....In the case at bar, it is clear that if the McLean space vehicle were modified as suggested it would no longer be capable of performing its intended target-seeking function. Thus, the suggested changes are not obvious changes."

Nor would one select from Lachenal et al certain features convenient to a rejection while ignoring those features contrary to the invention but necessary to get Lachenal et al's results (such as high kappa number pulp, and lignin is removed). In this regard see *In re Kamm*, 172 USPQ 298, 301, 302 (CCPA 1972) wherein the Court held:

"The rejection here runs afoul of a basis mandate inherent in §103 -- that 'a piece-meal reconstruction of the prior art patents in the light of appellants' disclosure' shall not be the basis for a holding of obviousness. In *re Rothermel*, 47 CCPA 866, 870, 276 F.2d 393, 396, 125 USPQ 328, 331 (1960). 'It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.' ... However, we are satisfied that when the secondary references are viewed in their entirety, with due consideration given to what they fail to disclose and what they disclose as undesirable, it is evident that the proposed modification of the primary reference would not have been obvious to one of ordinary skill in the art at the time the invention was made." (Emphasis added.)

With respect to the dependent claims, and features of claims 18 and 20, the references are even more far afield. For example the time period set forth in claims 3, 18, 20, and 27 is not fairly suggested by the '695 reference, in combination with the

other claim limitations nor is there any reason why one of ordinary skill in the art would employ them (nor any *prima facie* case established in the Final Rejection). The general statement in lines 55 through 59 on page 3 of the '695 reference does not suggest the maximum recited time with the maximum recited temperature, namely 95°C at 120 minutes. Rather the fair implication of the statements there -- especially with the knowledge of one of ordinary skill in the art regarding pulp viscosity reduction as made clear by paragraphs 8 and 9 and the associated tables referenced therein, of the first Vuorinen declaration -- is that if one were going to use the non-preferred, maximum, temperature of 95°C one would seek the low time range, such as 1-10 minutes, which is of course clearly outside the scope of these claims. Also since the invention teaches unexpectedly good results (and in fact different results) as a result of the optimization that is provided according to the invention, there could be no proper allegation of obviousness. *In re Waymouth*, 182 USPQ 290 (CCPA 1974); *In re Saether*, 181 USPQ 36 (CCPA 1974); *In re Antonie, supra*.

With respect to claim 7 there clearly and unequivocally is no teaching of the preferred ranges set forth herein, nor of the advantageous results therefrom, as confirmed by the Vuorinen declarations. The temperature set forth in claim 8 is specifically contrary to the references. There is no suggestion in the references of removal of the amount of hexenuronic acid set forth in claim 10, nor of the parameters set forth in claim 11. A pH of about 3-4, as set forth in claim 11 (and also claims 22-28), is an optimized pH range for the practice of the invention as described in the first Vuorinen declaration, but is distinctly higher than the optimized range in the references, and in fact is specifically contrary to the references. With respect to all of 7, 8, 10, and

11 nor is there any reason why one of ordinary skill in the art would employ the specific recitations therein (or any *prima facie* case established in the Final Rejection).

The kappa number of claim 12 even more clearly distinguishes from Lachenal et al where a high kappa number is necessary. There is no suggestion whatsoever in the references that the pulp should be bleached in a single hydrogen peroxide stage, or that pulp could be produced having a post color number of less than 2, as recited in claim 14. There is not even the most remote suggestion in the references of the possibility of reducing the kappa number in the manner set forth in claim 16 or the production of pulp with a post color number less than 2 as also set forth therein, and again the kappa number set forth in claim 17 is even more far afield from Lachenal et al, making the Lachenal et al teachings even more contrary. With respect to all of 12, 14, 16, and 17, nor is there any reason why one of ordinary skill in the art would employ the specific recitations therein (or any *prima facie* case established in the Final Rejection).

With respect to claim 19 there is no suggestion in the references of any possibility of removing about 80-97% of the hexenuronic acid, and with respect to claim 21 there is no suggestion whatsoever of producing a pulp with a pc number of less than 2. With respect to claims 22 through 28 the optimized pH range therein is not only not suggested by the references but specifically contrary thereto, and other features of some of these claims are also clearly not present in the applied references. With respect to all of 19 and 22-28, nor is there any reason why one of ordinary skill in the art would employ what is specifically called for therein (or any *prima facie* case established in the Final Rejection).

The invention is a remarkable advance in the art, and recognized as such by those in the art. An illustration of this is provided by the fact that inventor Vuorinen and others have published an article in the TAPPI 1996 International Pulp Bleaching Conference entitled "Subjective Hydrolysis of Hexenuronic Acid Groups and Its Application in EFC and TCF Bleaching of Kraft Pulps" (a copy of this TAPPI Proceedings article was earlier provided). This illustrates the significance of the invention and the interest therein by those in the art. Also significant is the additional information submitted November 5, 1997, which has not been acknowledged or commented on in the previous Action.

Thus, contrary to what is alleged in the Final Rejection there simply and unequivocally is no suggestion whatsoever for even the basic approach taken by the appellants since the prior art did not recognize that hexenuronic acid removal would have the advantages that are associated with it according to the claimed invention. The entire allegation that the advantages obtained by the appellants is apparent from the prior art is based completely upon impermissible hindsight, not upon a valid teaching from the prior art without the benefit of applicant's disclosure. See *In re Rouffet*, 149 F.3d 1350, 47 USPQ 2d 1453, 55-9 (Fed. Cir. 1998):

"To reject claims in an application under section 103, an examiner must show an un rebutted prima facie case of obviousness. See *In re Deuel*, 51 F.3d 1552, 1557, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995). In the absence of a proper prima facie case of obviousness, an applicant who complies with the other statutory requirements is entitled to a patent. See *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of prima facie obviousness or by rebutting the prima facie case with evidence of secondary indicia of nonobviousness. See *id.*

When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. See *In re Geiger*, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987). Although the suggestion to combine references may flow from the nature of the problem, see *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996), the suggestion more often comes from the teachings of the pertinent references, see *In re Sernaker*, 702 F.2d 989, 994, 217 USPQ 1, 5 (Fed. Cir. 1983), or from the ordinary knowledge of those skilled in the art that certain references are of special importance in a particular field, see *Pro-Mold*, 75 F.3d at 1573 (citing *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24, 227 USPQ 657, 667 n.24 (Fed. Cir. 1985)). Therefore, "[w]hen determining the patentability of a claimed invention which combines two known elements, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.'" See *In re Beattie*, 974 F.2d 1309, 1311-12, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992) (quoting *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1462, 221 USPQ 481, 488 (Fed. Cir. 1984)). ...

As this court has stated, "virtually all [inventions] are combinations of old elements." *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 698, 218 USPQ 865, 870 (Fed. Cir. 1983); see also *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1579-80, 219 USPQ 8, 12 (Fed. Cir. 1983) ("Most, if not all, inventions are combinations and mostly of old elements."). Therefore an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be "an illogical and inappropriate process by which to determine patentability." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570, 38 USPQ2d 1551, 1554 (Fed. Cir. 1996).

To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.

Because the Board did not explain the specific understanding or principle within the knowledge of a skilled artisan that would motivate one with no knowledge of Rouffet's invention to make the combination, this court infers that

the examiner selected these references with the assistance of hindsight. This court forbids the use of hindsight in the selection of references that comprise the case of obviousness. See *In re Gorman*, 933 F.2d 982, 986, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). Lacking a motivation to combine references, the Board did not show a proper prima facie case of obviousness. This court reverses the rejection over the combination of King, Rosen, and Ruddy."

Here the same inference of hindsight analysis is at least as clear as it was in

*Rouffet, supra*. All of the claims are clearly allowable.

### **IX. CONCLUSION**

In conclusion it is believed that the application is in clear condition for allowance; therefore, early reversal of the Final Rejection and passage of the subject application to issue are earnestly solicited.

Respectfully submitted,

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APPENDIX

1. A method of treating chemical cellulose pulp produced by alkaline delignification and having a kappa number of under 24, having hexenuronic acid therein, comprising the steps of:

(a) treating chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 and at a solids consistency of between 0.1-50% by treating the pulp at a temperature over 85°C and at a pH between about 2-5 for sufficient time to remove at least 50% of the hexenuronic acid and to reduce the kappa number by at least 2 units; and

(b) bleaching the chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 in at least one bleaching stage.

3. A method as recited in claim 1 wherein step (a) is practiced for at least a time t, where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where T is the treatment temperature in degrees C.

4. A method as recited in claim 1 wherein step (b) is practiced by bleaching the pulp with chemicals reacting electrophilically in at least one stage, and wherein step (a) is practiced before step (b).

5. A method as recited in claim 4 wherein step (b) is practiced by chlorine, chlorine dioxide, ozone, or peracid bleaching.

6. A method as recited in claim 1 wherein step (a) is practiced with the pulp at a consistency of between 1-20%.

7. A method as recited in claim 6 wherein step (a) is practiced at a temperature of between about 90-110°C, and a pH of between about 2.5-4.

8. A method as recited in claim 1 wherein step (a) is practiced by controlling the pH by the addition of an inorganic or organic acid, and at a temperature over 100°C.

10. A method as recited in claim 1 wherein step (a) is practiced for sufficient time to remove at least 80% of the hexenuronic acid.

11. A method as recited in claim 10 wherein step (a) is practiced at a temperature of between about 90-110°C and a pH of between about 3-4 for between 10-240 minutes.

12. A method as recited in claim 1 wherein the pulp treated in step (a) is hardwood pulp having a kappa number of about 14 or less.

13. A method as recited in claim 1 wherein step (b) is practiced by bleaching the pulp in an ozone stage, followed by at least one additional bleaching stage.

14. A method as recited in claim 1 wherein step (b) is practiced by bleaching the pulp with a single hydrogen peroxide stage, and no other bleaching stages, to produce pulp having a post color number of less than 2.

15. A method as recited in claim 1 wherein step (b) is practiced by bleaching the pulp in an oxygen stage, followed by at least one additional bleaching stage.

16. A method as recited in claim 1 wherein step (a) is practiced to reduce the kappa number about 3-6 units, and to remove at least 80% of the hexenuronic acid, and so that the pulp produced has a post color number less than 2.

17. A method as recited in claim 3 comprising the further step of delignifying the pulp with oxygen prior to step (a) so that it has a kappa number of about 14 or less; and wherein step (b) is practiced after step (a).

18. A method of producing chemical cellulose pulp, comprising the steps of:

(a) effecting alkaline delignification of comminuted cellulosic fibrous material to produce chemical cellulose pulp having a kappa number of under 24, and having hexenuronic acid therein;

(b) treating the chemical cellulose pulp from step (a) at a temperature of between about 90-180°C and at a pH between about 2-5 for at least a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C, to remove at least 50% of the hexenuronic acid from the pulp; and

(c) bleaching the chemical cellulose pulp from step (a) in at least one bleaching stage prior to, simultaneously with, or after step (b).

19. A method as recited in claim 18 wherein step (b) is practiced at atmospheric pressure for a time between 10-360 minutes, or at super atmospheric pressure and a temperature of over 100°C for a time between 5-100 minutes, and to remove about 80-97% of the hexenuronic acid.

20. A cellulose chemical pulp produced by the steps of:

(a) effecting alkaline delignification of comminuted cellulosic fibrous material to produce chemical cellulose pulp having a kappa number of under 24, and having hexenuronic acid therein;

(b) treating the chemical cellulose pulp from step (a) at a solids consistency between 0.1-50% at a temperature of between about 90-180EC and at a pH between

2.0-5.0 for at least a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C, to remove at least 50% of the hexenuronic acid from the pulp; and

(c) bleaching the chemical cellulose pulp from step (a) in at least one bleaching stage prior to, or after, step (b), so that the pulp has a brightness of at least about 80 ISO.

21. A cellulose chemical pulp as recited in claim 20 wherein step (c) is practiced using hydrogen peroxide, and wherein the pc number of the pulp is less than two.

22. A method as recited in claim 1 wherein step (a) is practiced at a pH between about 3-4.

23. A method as recited in claim 18 wherein step (b) is practiced at a pH between about 3-4.

24. A cellulose chemical pulp as recited in claim 20 wherein step (b) is practiced at a pH between about 3-4.

25. A method as recited in claim 3 wherein step (a) is practiced at a pH between about 3-4.

26. A method as recited in claim 25 wherein step (a) is practiced at a temperature at or above approximately 90°C.

27. A method of treating chemical cellulose pulp produced by alkaline delignification and having a kappa number of 25.9 or less, having hexenuronic acid therein, comprising the steps of:

(a) treating chemical cellulose pulp produced by alkaline delignification having a kappa number 25.9 or less at a solids consistency of between 0.1-50% by treating the

pulp at a temperature over 85°C and at a pH between about 3-4 for a time  $t$ , where  $t = 0.5 \exp(10517/(T+273)-24)$ , in minutes, and where  $T$  is the treatment temperature in degrees C; and

(b) bleaching the chemical cellulose pulp produced by alkaline delignification having a kappa number 25.9 or less in at least one bleaching stage.

28. A method as recited in claim 27 wherein step (a) is practiced at a temperature of between about 90-180°C.

29. A method of treating and bleaching chemical cellulose pulp produced by alkaline delignification and having a kappa number under 24, having hexenuronic acid therein, comprising the steps of:

(a) treating chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 and at a solids consistency between 0.1-50% by treating the pulp at a temperature over 85°C and at a pH between about 2-5 for sufficient time to remove at least about 50% of the hexenuronic acid and to decrease the kappa number of the pulp by at least 2 units; and

(b) bleaching the chemical cellulose pulp from step (a) in at least one bleaching stage with chlorine, chloride dioxide, ozone, or peracid.

30. A method of treating and bleaching chemical cellulose pulp produced by alkaline delignification and having a kappa number under 24, having hexenuronic acid therein, comprising the steps of:

(a) treating chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 and at a solids consistency between 0.1-50% by treating the pulp at a temperature over 85°C and at a pH between about 2-5 for sufficient time to

remove at least about 50% of the hexenuronic acid and to decrease the kappa number of the pulp by at least 2 units;

(b) treating the pulp with a chelating agent; and

(c) bleaching the pulp in at least one bleaching stage with peroxide.

31. A method of treating and bleaching chemical cellulose pulp produced by alkaline delignification and having a kappa number under 24, having hexenuronic acid therein, comprising the steps of:

(a) treating chemical cellulose pulp produced by alkaline delignification having a kappa number under 24 and at a solids consistency between 0.1-50% by treating the pulp at a temperature over 85°C and at a pH between about 2-5 for at least a time t, where  $t = 0.5 \exp (10517/(T+273) - 24)$  to remove at least about 50% of the hexenuronic acid and to decrease the kappa number of the pulp by at least 2 units; and

(b) bleaching the chemical cellulose pulp from step (a) having the reduced kappa number and the reduced hexenuronic acid content in at least one bleaching stage with peroxide.